CHAPTER 2

NON-MEDICAL NUCLEAR, BIOLOGICAL, AND CHEMICAL WARFARE DEFENSE REQUIREMENTS AND RESEARCH AND DEVELOPMENT PROGRAM STATUS

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2.1 INTRODUCTION

This chapter describes the consolidation of Joint Service non-medical NBC defense requirements and assesses how these programs meet the needs of the Force. The discussion of requirements and the status of research and development assessments is conducted within the framework of the three principles of NBC defense doctrine for the mission area:

- Contamination avoidance
- Protection
- Decontamination

As defined in Joint Pub 3-11, *Joint Doctrine for Nuclear, Biological, and Chemical Defense*, contamination avoidance includes detecting, avoiding, and bypassing contaminated areas. Protection consists of individual and collective protection. Decontamination restores combat power and is essential for sustaining operations in a contaminated environment. Medical programs support these areas and are discussed in Chapter 3.

The threat from the continued proliferation of NBC weapons—as described in the Introduction—creates a continuous need to ensure that U.S. forces can survive, fight, and win in an NBC threat environment. The increasing danger from these weapons demands that we look for every opportunity to avoid technological surprises. Evolving operational requirements demand that the joint program progressively capture and leverage advances in technology to provide the best in NBC defense equipment for the forces.

The key to the successful implementation of research, development, and acquisition (RDA) strategy is the concept of continuous incremental investment. Our RDA goal is to equip the Force with sufficient quantities of world-class equipment and in the shortest time possible in order to win decisively, quickly, and with minimal casualties. As authorized under the Joint Service Agreement for non-medical programs and in cooperation with the Armed Services Biomedical Research, Evaluation and Management (ASBREM) Committee for medical programs, the Army as executive agent coordinates, integrates, and reviews the DoD NBC Defense Program. The results of these reviews, conducted with all Services participating, are documented in the Joint Service Modernization and Joint Service RDA Plans. These documents form the basis for the consolidated NBC defense Program Objectives Memorandum (POM).

The Services in coordination with the Commanders-in-Chief (CINCs) decide if a material solution is needed to satisfy a requirement for a war fighting capability. They first look at doctrinal, training, or organizational solutions (non-material solutions), and when these cannot be found, they seek equipment solutions through the materiel acquisition cycle. If a valid need exists, then the research and development modernization process will identify technology approaches which may provide a new system or upgrade an existing system.

During FY97 the Joint Service Integration Group instituted an initiative to coordinate the development of Joint Future Operational Capabilities (JFOC). The goal of the JFOC effort is to identify and prioritize Joint User (Services and CINCs) far-term future operational capabil-

ities as expressed in the emerging Joint NBC Defense Concept. The overall intent is to provide enhanced User guidance to the Joint NBC Defense Science and Technology (S&T) community to assist in the NBC S&T program formulation and program execution process. The JFOC effort will also support the development of new NBC Defense Joint Mission Needs Statements (JMNSs) and future Joint Operational Requirement Documents (JORDs). During FY98 the draft JFOCs will be finalized and will be prioritized. The result will be a prioritized list of JFOCs which will establish a clearer link between near and long term Joint NBC Defense research and development efforts and User needs. The final prioritized list will become an integral part of the Joint Service NBC Defense Modernization Plan and related science and technology plans, including the Joint Warfighting Science and Technology Plan and the Defense Technology Area Plan.

In accordance with our national strategy of achieving and applying technological superiority, several underlying concepts form the foundation of acquisition modernization. The first is the need to reduce cycle time in the acquisition of new systems or the integration of emerging technologies into existing systems. The use of Advanced Concept Technology Demonstrations (ACTDs), open systems and architectures, along with the new emphasis on commercial standards and practices, allow us to shorten the acquisition cycle time. Our program acquisition process reduces overall costs through practices such as design-to-cost and concurrent engineering to ensure that equipment is easy to maintain and repair even with the inherent complexity in most new systems.

2.2 NBC DEFENSE MISSION AREA REQUIREMENTS AND RDA SUMMARY

The NBC Defense programs are categorized broadly under three operationally oriented areas: contamination avoidance, protection, and decontamination. Over the past two years, the Services have been working closely together to increase jointness in ongoing programs for each of these areas. This report highlights improvements during FY97 and discusses cooperative efforts for further Joint development of requirements. This section summarizes the requirements in each of the mission commodity areas. Tables 2-1 through 2-9 display requirements and acquisition strategies. Since the focus of this chapter is on research and development efforts, fielded items are not included in these tables. Descriptions of fielded equipment can be found in Annexes A–C at the end of this report.

2.3 CONTAMINATION AVOIDANCE (Detection, Identification and Warning)

The operational concept of contamination avoidance includes NBC reconnaissance, detection, identification, warning and reporting. Earliest possible warning is the key to avoiding NBC contamination. For fixed sites where contamination cannot readily be avoided and for missions requiring operations in a contaminated environment, detection, identification, and warning are equally critical to ensure that forces assume the optimal protective posture so that they can continue to sustain operations. Sensors for the individual soldier and systems capable of detecting multiple agents and characterizing new agents are being developed. Advances in technology are being pursued in chemical and biological standoff, remote/early warning detection, miniaturization, improved detection sensitivity, improved logistics supportability, and

affordability. The following sections detail contamination avoidance science and technology efforts, modernization strategy, and Joint Service programs.

2.3.1 Contamination Avoidance Science and Technology Efforts

2.3.1.1 Goals and Timeframes. The goal of contamination avoidance is to provide near real-time capability to detect, identify, characterize, locate, and warn against all CB warfare agent threats below threshold effects levels (see Table 2-1). Far-term science and technology efforts focus on multi-agent sensors for biological agent detection and remote/early warning CB detection. These far-term objective technologies seek to integrate chemical and biological point and remote/early warning detection modules into a single system. To meet near-term needs, a number of sensor technologies are being optimized while alternative detection technologies mature. R&D efforts seek to optimize system sensitivity, size/weight, cost, power consumption, signature and false alarm rate. Ultimately the goal is direct integration of CB detectors into various platforms, and command, control, communication, computer, and intelligence (C^4I) networks.

Table 2-1. Contamination Avoidance Science and Technology Strategy

By 1998	By 2003	By 2008
• Complete fabrication of tunable, eye safe laser for standoff aerosol cloud detection • Joint Chemical Agent Detector (JCAD) transition to Engineering & Manufacturing Development (EMD) • Complete Air Base/Port Bio Detection ACTD • Demonstrate integrated point biodetection capability (Advanced Technology Demonstration)	• Field upgrade (eye safe) Long Range Bio Stand-off Detector in FY99–01. • Complete development of CB water monitor • Joint Biological Remote/Early Warning System (JBREWS) ACTD with fielding of ACTD systems to selected CINCs by FY01 • Complete development of Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) • JBREWS production in FY02, and first unit equipped (FUE) in FY02	• Demonstrate integration of chemical and biological agent detection modules into a single sensor suite • Transition hand-held equipment chemical contamination scanner to EMD

2.3.1.2 Potential Payoffs and Transition Opportunities. The future CB detection system will provide the capability to detect, identify, map, and track all CB contamination in a theater of operations. This will enable commanders to avoid CB contamination or to assume the appropriate protection required to continue fighting and sustain their mission with minimal performance degradation and casualties. The program seeks to develop small, lightweight chemical detectors that can be incorporated into clothing ensembles to provide an individual chemical detection capability. CB detection technologies have dual use potential in monitoring air pollution, noxious fumes inside enclosed areas, and municipal water supplies.

2.3.1.3 Major Technical Challenges. The major technical challenges are in the areas of biological detection and identification, including remote/early warning sensing, improved agent discrimination and quantification, sampling efficiency, interferent and ambient biological background rejection, and genetic probe development. Size reduction of detectors, development of integrated biological and chemical detection systems, and the fusion of sensor data with mapping, imagery, and other data for near real-time display of events are other areas of challenge.

2.3.2 Contamination Avoidance Modernization Strategy

The increased lethality and heightened operational tempo of the future battlefield demand responsive NBC detection and warning capabilities in order to reduce force degradation caused by contamination. These capabilities—which also encompass NBC reconnaissance, identification, and reporting—have the strongest urgency for force readiness and will continue to be emphasized by the DoD community in the near and distant future. Table 2-2 shows the roadmap of DoD requirements for contamination avoidance.

Table 2-2. Contamination Avoidance Modernization Strategy

	NEAR (FY98-01)	MID (FY 02-06)	FAR (FY 07-12)
Chemical Point	• **Surface sampling capability (ICAM)** • **Automatic point detection of nerve and blister agents (ACADA)** • Navy-*Ship based improved automatic point detection of nerve/mustard (IPDS)* • Navy-*Automatically detect liquid agent (SALAD)*	• **Improved, all-agent programmable automatic point detection; portable monitor, miniature detectors for aircraft interiors; interior ship spaces; individual soldiers (JCAD)** • **Detection of CB contamination in water (Joint Service Agent Water Monitor)**	• **Improved surface contamination monitor** • **Low dosage miniature detector; specific identification; personal monitor**
Biological Point	• **Automatic point/mobile biodetection to detect and identify bio-agents; programmable (JBPDS Block I)** • Navy-*Ship based Interim Biological Agent Detector (IBAD)* • Army-*Biological Integrated Detection System (BIDS)*	• **Automatic point biodetection, to detect and identify; programmable (JBPDS Block II)** • **Biological Remote Early Warning System - A distributed network of fully automated lightweight sensors.**	• **Automated detection of all validated biological threat agents (Joint Biological Universal Detector, JBUD)**
NBC Reconnaissance and CB Remote and Stand-off Detection	• **Improved NBC Reconnaissance Vehicle with remote/early warning and data infusion capabilities (JSNBCRS)** • Army - *Long Range Stand-off detection and mapping of aerosol clouds (LR-BSDS)*	• **Biological remote detection and early warning capabilities (JBREWS)** • **Lightweight passive stand-off detection for chemical agent vapors (JSLSCAD)** • **Addition of biological detection and identification capabilities (JSNBCRS P3I)** • **Light reconnaissance vehicle (JSLNBCRS)**	• **Stand-off detection, ranging, and mapping of chemical vapors and aerosols (JSCWILD)** • **Wide area detection**
Warning and Reporting	• **Initial automated warning and reporting interoperable with all Services, C4I (JWARN)**	• **Integrated and automatic NBC warning and reporting: mission management (JWARN P3I)**	
Radiation Detection	• Army-*Compact, digital whole body radiation measurement (AN/UDR-13)*		• **Stand-off radiation detection and measurement** • **Portable radiation meter**

1. Joint Service programs are highlighted in **BOLD**; Service unique efforts are *italicized.*
2. Where applicable, systems which meet requirements are listed following the entry.

Early detection and warning is the key to avoiding NBC contamination. As a result, DoD is concentrating RDA efforts on providing its warfighters real-time capabilities to detect,

identify, quantify, and warn against all CB warfare threats below threshold effects levels. Real time detection of biological agents below threshold effects levels is unlikely in the near to mid-term. Current emphasis is on developing light weight, automated CB sensors capable of providing enhanced detection and early warning, capable of detecting all known biological and chemical agents. To meet the needs of the next three to five years, several stand-alone detectors and sensors are being developed. As detection technology matures, development efforts will focus on system miniaturization, improved sensitivity, agent characterization and range, decreased false alarm rate, and decreased operation and support costs. This focus will facilitate the integration of chemical detectors into personal warfighter gear, chemical and biological detectors onto various air, sea, and ground platforms, and integration of detectors into automated warning and reporting networks. Table 2-3 provides an overview of RDA efforts and Service involvement.

Table 2-3. Contamination Avoidance RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Automatic Detectors and Monitors	- M22 Automatic Chem Agent Detector (ACADA)	Production	Joint	Joint	Joint	Rqmt
	- Shipboard Liquid Agent Detector (SALAD)	RDTE				Rqmt
	- Improved Point Detection System (IPDS)	Production				Rqmt
	- Improved CAM (ICAM)	Production	Rqmt	Interest	Rqmt	Interest
	- Joint Service Agent Water Monitor (JSAWM)	RDTE	Joint*	Joint*	Joint*	Interest
	- Joint Chemical Agent Detector (JCAD)	RDTE	Joint*	Joint*	Joint*	Joint*
	- Biological Point Detection					
	--Interim Biological Agent Detector (IBAD)	Production				*Rqmt*
	--Biological Integrated Detection System (BIDS NDI)	Fielded	*Rqmt*			
	--BIDS P3I	RDTE	*Rqmt*			
	- Joint Bio Point Detection System (JBPDS)	RDTE	Joint	Joint	Joint	Joint
Remote/ Early Warning	- Joint Service Lightweight Stand-off Chemical Agent Detector (JSLSCAD)	RDTE	Joint	Joint	Joint	Joint
	- Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD)	RDTE	*Rqmt*	*Rqmt*		
	- Biological Stand-off					
	--Joint Remote Biological Early Warning System (JBREWS)	RDTE	Joint	Joint	Joint	Joint
	--Long Range Bio Stand-off Detection System-NDI (LRBSDS-NDI)	Production	*Rqmt*	*Interest*		*Interest*
	--LRBSDS P3I	RDTE	*Rqmt*	*Interest*		*Interest*
NBC Recon	- Joint Service NBC Reconnaissance System (JSNBCRS)	RDTE				
	--M93A1 NBCRS/CB Mass spectrometer (See BIDS)	*	*Rqmt*		*Rqmt*	
	--Joint Service Light NBCRS/Lightweight Recon System (JSLNBCRS)	*	Joint*	Joint*	Joint*	*Interest*
Warning and Reporting	- Joint Warning and Reporting Network (JWARN)	RDTE	Joint*	Interest*	Joint*	Joint*
	-- Multipurpose Integrated Chemical Agent Detector (MICAD)	*	*Rqmt*	*Interest*	*Rqmt*	
Radiation Detection	- AN/UDR-13 Pocket Radiac	Production	Joint	Interest	Joint	

Joint= Joint Service requirement
Joint*=Draft Joint Service requirement
Rqmt= Service requirement
int-NIR= Service interest, no imminent requirement
Rqmt, Interest= sub-product requirement or interest *= Sub-product(s) of a Joint project

The management challenge involves the coordination and consolidation of dozens of detection and warning RDA efforts across the Services. This strategy, led by the JSMG through the Contamination Avoidance Commodity Area Manager (formerly the Joint Service Detection Working Group), resulted in the initiation of RDA efforts which shared common technical goals, but were constrained to Service unique requirements. Management organizations and initiatives, such as the Joint Program Office for Biological Defense (JPO-BD) and the Joint NBC Defense Board are building Joint Service coordination across the mission area.

Over the past four years, JPO-BD has managed several single service and joint biological detection programs. Three single service biodetection programs fielded in the past year, in which JPO-BD has managed include:

- the Navy's Interim Biological Agent Detector (IBAD); 25 detectors are being fielded throughout FY96–99,
- the Army's Biological Integrated Detection System - Non-Developmental Item (BIDS NDI), which has been type classified limited procurement, and fielded to the 310th Chemical Company (USAR), and
- the Army's Long Range Biological Standoff Detection System (LR-BSDS NDI), which has been type classified standard, and fielded this year to the 310th Chemical Company (3 systems).

Key joint systems JPO-BD manages include:

- The Army's Biological Integrated Detection System, Pre-Planned Product Improvement. This program provides increased automation, doubles the number of agents detected and identified (4 *vs.* 8) and reduces identification time (<30 min).
- The Joint Biological Point Detection System (JBPDS) which entered Engineering and Manufacturing Development (EMD) phase in FY97. The JBPDS will be the first truly joint biological detection acquisition program that is built on an approved Joint Operational Requirements Document (JORD).
- The Air Base/Port Bio Detection (Portal Shield) Advanced Concept Technology Demonstration (ACTD) which has undergone two major field trials, completed drafting of a Concept of Operations (CONOPS), and will be deployed in late FY98.
- The Joint Biological Remote/Early Warning System (JBREWS) ACTD which starts development in FY98. The JBREWS ACTD is also funded through the Counterproliferation Support Program.

Over the past three years, the JSMG and JSIG, through the Contamination Avoidance Commodity Area Manager, with assistance from JPO-BD transformed and consolidated 44 separate contamination avoidance developmental efforts into nine fully coordinated joint projects. The Joint Programs are:

- Automatic Chemical Agent Detector Alarm (ACADA)
- Joint Chemical Agent Detector (JCAD)
- Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)
- Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD)
- Joint Biological Point Detection System (JBPDS)
- Joint Biological Remote Early Warning System (JBREWS)
- Joint Service Light NBC Reconnaissance System (JSLNBCRS)
- Joint Warning and Reporting Network (JWARN)
- Joint Service Agent Water Monitor (JSAWM)

2.3.3 Joint Service Contamination Avoidance Programs

The consolidation of Joint Service contamination avoidance programs has been completed. All detection programs have been restructured to meet current multi-Service needs. Bolded entries in Table 2-2 highlight Joint programs. Detailed descriptions of Joint contamination avoidance programs are provided in Annex A.

Chemical Warfare Agent Contamination Avoidance

A non-developmental item (NDI) Automatic Chemical Agent Detector (ACADA) is being purchased for point detection of low level chemical agent vapors. ACADA is suitable for many vehicle-mounted and man-portable applications. The Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) for passive standoff, on-the-move detection of chemical agent vapor is in Phase II (Engineering and Manufacturing Development, EMD) of the acquisition cycle. The basic system (detector, scanner and electronics module) of JSLSCAD will weigh approximately 30 pounds and occupy approximately 1 cubic foot. The system may be modified to accommodate a variety of requirements. To date, a 360° x 60° scanner was developed for Armored Systems Modernization applications (tracked and wheeled vehicles), and the system was integrated into a gimbal for Marine Corps helicopters and unmanned aerial vehicle (UAV) contamination avoidance roles. This system is also being considered by the Navy for shipboard use and by the Air Force for use at air bases.

In the near-term, the four Services are focusing on the development of the Joint Chemical Agent Detector (JCAD). The JCAD will function as a chemical point detection system in order to accomplish a variety of mission requirements on multiple service platforms. This system will be considerably smaller and lighter than the ACADA and can be configured for a variety of applications such as individual soldier detectors, shipboard chemical agent monitoring, special operations forces (SOF) applications, and aircraft interior detection. The JSMG selected the Air Force as lead service for the JCAD. The Army, Air Force, and Marine Corps have also agreed to focus upon the development of a Joint Service Light NBC Reconnaissance System (JSLNBCRS). The proposed system will consist of a suite of detectors required for a specific mission which could be easily integrated into the platform of choice. Currently two configurations are proposed: a light and a medium version, to fulfill expeditionary and armored mission profiles, respectively. The FOX NBCRS would fulfill heavy requirements. The FOX NBCRS is being upgraded to include a chemical stand-off detection capability and other electronic improvements including data fusion.

In the mid- to far-term, the Army and Air Force have agreed to a Joint Service Chemical Warning and Identification LIDAR Detector (JSCWILD). JSCWILD is a laser-based standoff detection system being developed to meet the requirements for the detection of chemical liquids, aerosols, and vapors. Although this system is much heavier than its passive counterpart (JSLSCAD), it does provide the ability to detect chemical agents in all forms—liquids, vapors, aerosols—as well as mapping and ranging information. The JSLSCAD program is a joint program with an ORD being approved by all Services. The Air Force's primary use for this system will be air base defense. The Navy will install JSLSCAD on shipboard and airborne

platforms and at high priority oversea installations. A requirement for an agent water monitor has been identified by the Army, Air Force, and Marines. Joint program plans are being developed.

Biological Warfare Agent Contamination Avoidance

Currently, there are six biological detection efforts being conducted under the Joint Program Office for Biological Defense (JPO-BD):

(1) Interim Biological Agent Detector (IBAD);
(2) Joint Biological Point Detection System (JBPDS);
(3) Biological Integrated Detection System (BIDS);
(4) Long Range Biological Stand-off Detection System (LR-BSDS);
(5) Air Base/Port Biological Detection Advanced Concept Technology Demonstration (ACTD); and
(6) Joint Biological Remote/Early Warning System (JBREWS) ACTD.

Currently fielded systems include the Navy's shipboard detection system (IBAD) and the Army's land-based system (BIDS-NDI). The Army's LR-BSDS is a helicopter mounted infrared LIDAR system for the detection, ranging and tracking of aerosol clouds that may indicate a biological warfare (BW) attack. In the near-term, the Air Base/Port Biological Detection (Portal Shield) ACTD will develop and demonstrate the capability of networked sensors to protect high value fixed sites against BW attacks. The Joint Biological Point Detection System (JBPDS) will meet each of the four Services' needs for a biological point detector. This system will be integrated on Service designated platforms.

In the mid-term, the JPO-BD will develop the Joint Biological Remote Early Warning System. This distributed network of lightweight, automated sensors will provide enhanced detection, identification, and advanced warning of BW attacks.

In the far-term, JPO-BD's concept for the ultimate, joint service biological detector is the Joint Biological Universal Detector (JBUD). JBUD is envisioned to be a miniaturized, multi-technology, automatic system that may be manned or unmanned, capable of detecting all BW agents, and able to automatically warn troops and report pertinent data relative to a BW attack.

2.3.4 Warning and Reporting

Warning and reporting is a critical capability in contamination avoidance. The Services have agreed to expedite development of this capability by integrating ongoing hardware and software into a Joint Warning and Reporting Network (JWARN). This network will be compatible with, but not duplicate, all C^4I equipment both current and developmental. Initial urgent requirements of software will be fielded. In FY99 a Warning and Reporting Network of hardware and software will be fielded. This system will be integrated on Service designated platforms and installed at fixed sites.

2.3.5 Other Contamination Avoidance Programs

Various detection and warning requirements have unique mission profiles and technical specifications. While in some instances the development effort may leverage off the technical achievements of a closely related detection and warning project, the application beyond its intended mission is limited and accordingly supports a specific requirement. Starting in first quarter FY97, the Navy is producing the Improved (chemical agent) Point Detection System (IPDS), an upgrade for the existing shipboard Chemical Agent Point Detection System (CAPDS). IPDS, which offers continuous operation and advanced detection sensitivities that do not respond to shipboard interferents, is not adversely affected by the high electromagnetic environment around ships. IPDS improves detection thresholds, response time, and adds the capability to detect mustard agents. Installation of the IPDS will begin in FY98. The Navy is also developing the Shipboard Automatic Liquid Agent Detector (SALAD). This shipboard system will be used to automatically detect and alarm in the presence of liquid chemical agents. By detecting automatically, it will minimize the sailor's exposure to contamination. As with the IPDS, it will offer continuous operation and advanced detection sensitivities that do not respond to shipboard interferents and are not affected by naval electromagnetic interference (EMI).

2.3.6 Defense Advanced Research Projects Agency (DARPA) Programs

DARPA is pursuing breakthrough technologies in biological detection in their sensor program in the Defense Sciences Office. DARPA is developing technologies that will allow for the multiplexing capability of bioagent identification. Using up-converting phosphor technology, detection sensitivity and enhanced multiplexing is being developed in a hand-held biological sensor. Small biochips using ribosomal RNA are also being developed which can reveal family, genus, and species on a single chip. The mass spectrometer is being miniaturized and ruggedized for battlefield use in identification of biological agents and contaminants without the use of liquids. These systems will be automated so that they can be operated in an unattended fashion. Detection technologies that provide information on pathogenicity and viability are being developed under the DARPA biological detection program.

2.4 PROTECTION

When early warning is not possible or units are forced to occupy or traverse contaminated environments, protection provides life sustainment and continued operational capability in the NBC environment. The two types of non-medical protection are individual and collective.

- ***Individual protective equipment*** (IPE) includes protective masks and clothing. Protective masks that reduce respiratory stress on the user while improving compatibility with weapon sighting systems and reduce weight and cost are being developed. Technology advances are being pursued to produce mask systems that provide fully compatible vision capabilities, laser/ballistic protection, and further reduction in logistics burden. Protective clothing is being developed that will present less weight and heat stress burden than present equipment.

- ***Collective protection equipment*** (CPE) consists of shelters that provide a contamination-free, environmentally-controlled environment for soldiers to perform their mission, and generic NBC protective filters and air movement devices that provide filtered air. Collective protection, *i.e.*, overpressure, can be applied to mobile and fixed command posts, medical facilities, rest and relief shelters, buildings/fixed sites, vehicles, aircraft, and ships. Lightweight shelters integrated with NBC filtration, environmental control and power generation facilities for medical treatment facilities have been developed and are in production. Technology improvements are being pursued to reduce weight, volume, and cost and improve deployability. Technology improvements that reduce logistic and manpower requirements; *e.g.*, filter change frequency and shelter assembly and disassembly time are also being pursued.

2.4.1 Protection Science and Technology Efforts

2.4.1.1 Goals and Timeframes. The goals of the protection subarea are (1) to maintain a high level of protection against CB warfare agents and radiological particles while reducing the physiological burden associated with wearing protective equipment; (2) to integrate CB protection with protection from environmental, ballistic and other threats; and (3) to provide a protective environment for personnel to complete their mission and to provide rest and relief while operating in aircraft, armored vehicles, ships, shelters, and other large-area enclosures (see Table 2-4). To achieve these goals, physiological performance requirements key to the design and evaluation of clothing and respirators are being established. New barrier and filtration materials and permeable fabrics to accommodate these performance requirements, are being developed and evaluated. In addition, advances in collective protection are being explored that will developed filtration systems that can be used by multiple platforms and shelters and will be transitioned into several acquisition programs. Regenerative filtration materials and techniques that would virtually eliminate the need to replace collective protection filters are being explored.

Table 2-4. Protection Science and Technology Strategy

By 1998	By 2003	By 2008
• Prototype mask with 50% reduced breathing resistance and 50% improved field of vision • Joint Service Lightweight Suit Technology (JSLIST Component)	• Demonstrate regenerative filtration prototype for collective protection applications • Demonstrate advanced adsorbents to enhance or replace carbon • New chemical protective clothing, gloves and footwear materials	• Continuous operations filter technology • Lightweight materials available

2.4.1.2 Potential Payoffs and Transition Opportunities. Individual protection investments will result in improved respiratory and percutaneous (skin) protection with reduced physiological and psychological burden to the individual soldier. Improved air purification systems for collective protection applications will allow for extended operations in enclosures in a CB contaminated environment and reduce the logistics burden associated with filter replacement. Filtration technology has commercial application to the chemical industry and for automotive applications.

2.4.1.3 Major Technical Challenges. Integrating CB protection into future warrior systems necessitates tradeoffs between performance requirements and limitations of materials and designs. Integral respiratory protection requires tradeoffs between physiological performance parameters such as pulmonary function, field of view, speech intelligibility and anthropometric sizing against cost, size/weight, protection time, and interfacing with other equipment. Integral CB protective clothing requires tradeoffs between minimizing thermal stress and moisture buildup against agent resistance, weight/bulk, and power requirements of cooling systems. Air purification systems require tradeoffs with respect to size, weight and power requirements, as well as longer life and minimal environmental impact.

2.4.2 Protection Modernization Strategy

Forces cannot always avoid NBC hazards, therefore, individual warfighting units must be provided materiel to protect them from the effects of these lethal agents. Protection must be effective against all known threats with minimal degradation to the performance of personnel, weapons, or equipment. Total NBC protective measures, which consist of individual and collective protection, allow our forces to maintain combat superiority in contaminated environments. A summary of protection modernization requirements is provided in Table 2-5.

The goal of the protection RDA area is to provide equipment that allows U.S. forces to operate in a NBC contaminated environment with minimal degradation of the warfighters' performance. The near-, mid-, and far-term project efforts are aimed at maintaining current protection levels while reducing physiological and logistical burdens. Table 2-6 provides an overview of individual and collective protection RDA efforts and Service involvement.

Individual protection equipment (IPE) consists of eye/respiratory and percutaneous protection: a mask, protective garments with hood, boots, and gloves. The IPE issued to U.S. forces protects against all threat chemical and biological agents. Its chemical defense capabilities are routinely demonstrated with actual chemical agents in the Chemical Defense Training Facility (CDTF), U.S. Army Chemical School, Ft. McClellan, Alabama.

Protective masks will be improved to provide greater user comfort and to reduce the breathing resistance currently encountered. Mask systems will require increased NBC survivability and compatibility with combat or personal equipment. Future respiratory systems, such as the A/P23P-14(V)N, the M45, and the mid-term Joint Service Aviation Mask (JSAM) and Joint Service General Purpose Mask (JSGPM) will require enhanced compatibility with life support equipment, tactical systems, and fixed and rotary wing aircraft. In the future, the focus will be on integrated respiratory protective ensembles which offer optimal compatibility with personal, tactical, and crew support systems.

Table 2-5. Protection Modernization Strategy

	NEAR (FY98-01)	MID (FY02-06)	FAR (FY07-12)
Individual Eye/ Respiratory	• **Voice amplification; laser/ballistic eye protection; improved decontamin-ability, better comfort (M40A1/M42A1)** • Army - *Aircrew mask compatible with Apache helicopter systems with a significantly lighter motor/blower unit (M48/M49)* • Army -*Improved compatibility with aviation sighting/night vision systems; reduced logistics burden using non-blower systems, selected for Land Warrior (M45)*	• **Reduced physiological burden, improved comfort, enhanced optical and communications, improved compatibility** • **New mask systems for general purpose and aviation masks (JSGPM, JSAM)** • Navy -*Improved complete protection for all aircrews (A/P 23P-14(V)N)*	• **Advanced Integrated Individual Soldier Protection system (Future Soldier System)** • **Improved multiple agent protection**
Individual Clothing	• **Advanced protective suit technology; lighter, improved agent and flame protection; reduced heat stress integrated with all respiratory systems.** **- Improved foot protection (MULO)** • **Improved protection, less burdensome, protective suits; Improved foot and hand protection/less burdensome (JSLIST P3I)** • **Improved protection for short term use for special purposes (ITAP)** • Army -*Improved protection with self contained breathing capability for special purposes (STEPO)*	• **Improved protection (Joint Service Chemical Ensemble)**	• **Integrated multiple threat modular protection (chemical, biological, environmental, ballistic direct energy and flame)** • **Improved protection for aviators (JPACE)**
Collective Protection	• **Improved filters to extend filter life, reduce maintenance and reduce logistical burden** • **Chemically Protected Deployable Medical Systems (CP DEPMEDS)** • **Chemically Hardened Air Transportable Hospital (CHATH)** • Navy - *Backfit ships with contamination free protected zones - (Selected Area Collective Protection System, SACPS), Integrate CP system into V-22* • Marine Corps -*Protection for all combat vehicles and unit shelters* • Army -*NBC protection for tactical Medical units (CB Protective Shelter, CBPS),* *- Apply regenerable filter to Comanche,* *- Apply CP to advanced vehicle concepts.* *-Modular, reduced size, weight and power for vehicle/ shelter collective protection - Advanced Integrated Collective Protection Shelter (AICPS)* • Air Force - *Upgrade/install CP into existing rest/relief shelters.*	• **Regenerable protective filtration for vehicles/vans; reduces logistics burden, size, weight, power needs protects against future threat agents** • **Lighter, more mobile, more affordable shelters and equipment (JCPI)** • **Support medical treatment in a CB environment for Airborne, Air Assault, and Heavy Divisions (CBPS)**	• **Family of advanced lightweight protective filtration systems for vehicles, shelters, ships, light forces**

1. Joint Service programs are highlighted in **BOLD**, Service unique efforts are *italicized.*
2. Where applicable, systems which meet requirements are listed following the entry.

Table 2-6. Protection RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
	INDIVIDUAL PROTECTION:					
Integrated	- Force XXI Land Warrior	RDTE	Rqmt	Interest	Interest	Interest
Eye/	- MBU-19/P Aircrew Eye/respiratory Protection	Production	Interest	Fielded	Interest	
Respiratory	(AERP)					
Protective	- M48/49 Aircraft Mask	Production	Rqmt			
Masks	- CB Respiratory System (A/P 23P-14(V)N)	RDTE			Rqmt	
	- M45 Aircrew Protective Mask (ACPM)	Production	Rqmt		Interest	
	- M40A1/M42A1	Fielded	Rqmt		Rqmt	
	- MCU-2A/P	Production		Fielded		Rqmt
	- Joint Service Aviation Mask (JSAM)	RDTE	Rqmt	Rqmt	Rqmt	Rqmt
	- Joint Service General Purpose Mask (JSGPM)	RDTE	Rqmt	Rqmt	Rqmt	Rqmt
Ancillary	- Protection Assessment Test System (PATS)	Production	Rqmt	Fielding	Fielded	Interest
Equipment	- Voice Communication Adapter	Production	Rqmt	Rqmt	Fielded	Fielded
Battlefield	- CB Protective Overgarment Saratoga	Fielded	Interest		Fielded	Interest
Protective	- Chemical Protective Undergarment (CPU)	Fielded	Rqmt		Int-NIR	
Suits	- Joint Service Lightweight Integrated Suit					
	Technology (JSLIST/JSLIST P3I)					
	-- Overgarment	Prod.*	Rqmt	Rqmt	Rqmt	Rqmt
	-- Undergarment (P3I)	RDTE	Rqmt	Interest	Interest	
	-- Duty Uniform (P3I)	RDTE	Rqmt	Rqmt	Rqmt	
	-- Boots (MULO)	MS III*	Rqmt	Rqmt	Rqmt	
	-- Gloves (P3I)	RDTE	Rqmt	Rqmt	Rqmt	
Specialty	-Self-Contained Toxic Environment Protective Outfit	Fielded	Rqmt			
Suits	(STEPO-I) Interim					
	- STEPO	MS III	Rqmt			
	- EOD Ensemble	Production	Rqmt			
	- Improved Toxicological Agent Protective (ITAP)	RDTE	Rqmt	Rqmt	Interest	Interest
	COLLECTIVE PROTECTION					
Tentage and	- M20A1/M28 Simplified CPE	Production	Rqmt	Interest		
Shelter Systems	- CBPS (Medical)	Production	Rqmt		Interest	*
	- SACPS	Production			Interest	Rqmt
	- CP DEPMEDS/CHATH	Production	Rqmt	Rqmt		
CP Systems	- Shipboard Collective Protection System (CPS)	Production	Interest	Interest		Rqmt
	- Shipboard CPE	RDTE				Rqmt
	- Modular Collective Protection System (MCPE)	Fielded	Rqmt	Interest		Interest
	- AICPS for Vehicle, Vans, and Shelters	RDTE	Rqmt		Interest	
	- Portable Collective Protection System (PCPS)	Fielded			Rqmt	
	- M8A3 GPFU	Fielded	Rqmt			
	- M13A1 GPFU	Fielded	Rqmt			
Generic Filters	- M48/M48A1	Fielded	Rqmt		Rqmt	
	- M56	Fielded	Rqmt	Rqmt	Interest	Rqmt
	- Fixed Installation Filters	Fielded	Rqmt	Rqmt		

Rqmt = Product requirement
Interest = Product Interest
Int-NIR = Product Interest, No Imminent Requirement
* - Sub-Product(s) of a Consolidated Joint Service Project
Rqmt, Interest = Sub-Product requirement or Interest

Future protective clothing ensembles will be required for land, sea, air, and marine forces to achieve reductions in bulk and weight without any loss of protection or durability. To satisfy these needs, the four Services have consolidated their mission specific requirements into a first truly joint evaluation program for the next generation chemical garments—the Joint Service Lightweight Integrated Suit Technology (JSLIST) program. The JSLIST program developed

and field the JSLIST Overgarment and Multi-purpose Overboots (MULO). The JSLIST Pre-Planned Product Improvement (P3I) will develop improved chemical protective overgarments, duty uniforms, undergarments, gloves, and socks that will increase protection, reduce physiological burden, and have increased durability beyond those items fielded in the JSLIST program. New accessories, such as gloves and footwear, are required to execute missions and tasks which require greater tactility and traction. The Joint Protective Aircrew Ensemble (JPACE) will be developed to provide aviators the same advantages and improved protection as JSLIST provides to other warfighters. Similarly, clothing systems for Explosive Ordnance Disposal (EOD) personnel are required to enhance existing chemical protection systems without undue physiological burdens.

Collective protection equipment (CPE) development efforts are focused on NBC protection systems at the crew, unit, and platform level. New CPE systems will be smaller, lighter, less costly, and more easily supported logistically. New systems are required to make "clean" environments more available for critical operations (*i.e.*, where IPE otherwise places an unacceptable burden upon the Service member in performing duties) and for essential rest and relief. Modernization concentrates on: (1) improved air filtration and environmental control methodologies and integration, (2) advanced technologies integrated into power and ventilation for systems that offer a significant improvement in logistics, (3) applications on essential vehicles, vans, and shelters, and (4) improvements to current vapor and particulate filtration media to extend filter life. Efforts are in place to support major weapons systems developments, such as the V-22 Osprey, the Comanche, the Crusader, USMC Advanced Amphibious Assault Vehicle (AAAV), aircraft, and advanced armored vehicles.

2.4.3 Joint Service Protection Programs

Joint programs are shown in Table 2-5 as bolded entries. A detailed description of Joint IPE and CPE programs is provided in Annex B.

Individual Protection

Eye/Respiratory. The M40 and M42 masks (for individuals and armored vehicle crew-men, respectively) are undergoing the final stages of fielding to replace their M17 and M25 series counterparts. The new masks offer increased protection, improved fit and comfort, ease of filter change, better compatibility with weapon sights, and a second skin which is compatible with Army and Marine Corps protective ensembles. The second skin design also is being reviewed by the Navy and Air Force for potential adoption. The Army, Marines, and Air Force are also fielding the Protection Assessment Test Systems (PATS) to provide users of the M40, M42, and MCU-2/P masks with a rapid and simple means for validating the fit and function of the mask to ensure readiness. The Navy is evaluating the use of PATS with its MCU-2/P series mask.

The Navy, in coordination with the Marine Corps, is leading an effort to equip all forward deployed fixed and rotary wing aircrew with improved chemical, biological, and radiological (CBR) protection. The CBR ensembles will feature off-the-shelf items, such as the

A/P23P-14(V)N respiratory system. The Army, in cooperation with the Marine Corps, recently completed a product improvement program for the M40 series mask that allows ground crew to aircrew communication. The Air Force continues to field Aircrew Eye-Respiratory Protection (AERP) systems to protect aircrews from CB hazards. This system complements the recently fielded lighter weight aircrew ensemble.

Mid- and far-term research is focused on improved vapor and particulate filtration technology, as well as improved masks for light and special operations forces (SOF). Far-term plans include the Joint Service Aviation Mask and Joint Service General Purpose Mask, which will provide improved eye, respiratory, and face protection against current and future agents. It will maximize compatibility with future weapon systems, be lightweight, and offer modular facepieces to accommodate a variety of mission profiles. Protective mask efforts will focus on supporting specific needs of the Joint Services and integrated warrior programs (Land Warrior, Air Warrior, Mounted Warrior, and Force XXI).

Clothing. In the area of full body protection, the JSLIST program is underway to coordinate the selection of advanced technology chemical protective materials and prototype materials. The JSLIST Overgarment was adopted by all four services, and the Multipurpose Overboot (MULO) was adopted jointly by the Army, Air Force, and Marines. The JSLIST Overgarment is a 45 day garment that provides 24 hours of chemical protection. It is launderable and lighter weight than the Battle Dress Overgarment (BDO). The MULO will replace the current black vinyl overboot/green vinyl overboot (BVO/GVO). The MULO is a 60 day boot that provides 24 hours of chemical protection. The boot has increased traction, improved durability, POL and flame resistance, and better chemical protection than the BVO/GVO.

The JSLIST Pre-Planned Product Improvement (P3I) will address requirements not met through the JSLIST program. This program will obtain new material technologies for overgarments and duty uniforms using the existing JSLIST design. Fabric technologies for a chemical protective undergarment and materials and designs for chemical protective gloves and socks will also be addressed. This program will develop a 60 day overgarment with desired flame resistance (FR), a 30 day overgarment with required FR, a 30 day duty uniform with desired FR, a 7 day overgarment with desired FR, a 7 day undergarment with desired FR, general purpose gloves, high tactile gloves and socks. Materials that meet Service's requirements will be placed on a qualified materials list to encourage multi-source competition and to provide surge capability.

In the near to mid-term, the Army is developing an Improved Toxicological Agent Protective (ITAP) ensemble for EOD and depot operations in Immediate Danger to Life and Health (IDLH) contamination concentrations. The ITAP ensemble will incorporate improvements in material and design. It includes a one-hour supplied air bottle system, which can be switched to a filtered air respirator when operators exit the area of high contamination. A Personal Ice Cooling System (PICS) is being developed for use with the ITAP and STEPO. In addition, the Army is working with the Air Force on a chemical protective firefighter's ensemble, leveraging the technology from the JSLIST program.

In the far-term, efforts will focus on integrated protection for the Force XXI Land Warrior System. This next generation technology will be directed toward integrating CB protection into a system which will also provide environmental, ballistic, directed energy, and flame protection, as well as reduced physiological burden. A strong emphasis on supporting technologies must continue. Materials that detoxify a broad range of chemical and biological agents on contact, which can be incorporated into fibers, fabrics, and semi-permeable membranes are being developed using biotechnology, as well as more conventional approaches.

Collective Protection

The Army has produced the M20A1 and the M28 Simplified CPE to provide CP protection and environmental control to existing structures. The new CPE provides liquid agent resistance and allows expansion of protection area. The M20A1 has been fielded. The M28 Simplified CPE is integrated into CP DEPMEDS and CHATH field hospital.

CHATH and CP DEPMEDS are joint programs to integrate environmentally controlled collective protection into already fielded Army and Air Force field hospitals into order to sustain medical operations in a CP environment for 72 hours. Chemical protection is integrated into existing medical tents and shelters through addition of M28 Simplified CPE, chemically protected heaters, air conditioners, water distribution and latrine systems and alarms. CP DEPMEDS successfully completed an Operational Test 4Q97, with type classification scheduled for 4Q98 and fielding in FY99.

The Chemically and Biologically Protected Shelter (CBPS) is a highly mobile, rapidly deployable shelter system designed to be used for Echelon I and II forward area medical treatment facilities. The system is self contained/self-sustaining. It is permanently mounted onto a HMMWV with a Lightweight Multipurpose Shelter with a towed trailer and generator set. It transports a CB protected airbeam supported soft shelter, self-contained environmental support and power generation system, a crew of four and gear, and medical equipment. The system is presently in production with fielding scheduled to initiate 1Q99 following completion of an Operational Test in 2Q98. Mid-term objectives are to initiate development of CBPS to support medical treatment for Airborne, Air Assault and Heavy Divisions.

Other near-term collective protection efforts, such as the Advanced Integrated Collective Protection System (AICPS) will provide a compact, integrated package for power, filtration, and environmental control (heating/cooling). The AICPS will provide transportability and maintainability enhancements and decrease system set-up times. The Portable Collective Protection System (PCPS) provides an agent-free enclosure, eliminating the requirement to wear protective masks and clothing that inhibit performance. Improved shelters and equipment that are lighter, more affordable and more mobile are major products of the Joint Collective Protection Improvement (JCPI) Program. JCPI initiates engineering development in FY00. Redesign and concept tradeoff assistance regarding advanced filtration technologies, such as Pressure Swing Adsorption (PSA) and Catalytic Oxidation (CatOx) has been provided to the Comanche, Crusader, USMC AAAV, and U.S. Army advanced vehicle efforts. The USAF is currently upgrading their CP fixed site capabilities.

2.4.4 Other Protection Programs

Program supporting requirements of a single service are shown in Table 2-5 as italicized entries. A detailed description of IPE and CPE projects is presented in Annex B.

Individual Protection

Eye/Respiratory. The Army is developing the M48/49 protective masks to replace the M43 series masks. The M48 will be for Apache pilots and the M49 for general aviator use. They will be lighter and offer enhanced protection and compatibility with night vision and aircrew systems.

In the near-term, the Army will replace the M43 mask for the general aviator with the Aircrew Protective Mask, M45. The M45 is lighter and less expensive than the M43 and features CB protection without the aid of force ventilated air.

Clothing. The Army has approved fielding of the Self-Contained Toxic Environment Protective Outfit (STEPO). The STEPO is introduced for limited EOD and depot operations in contamination concentrations which are of Immediate Danger to Life and Health (IDLH). STEPO will replace the Interim STEPO (STEPO-I).

Collective Protection

The Navy now includes the Collective Protection System (CPS) on all new construction ships. Currently the DDG-51, LHD-1, AOE-6, and LSD-41 ship classes are being built with CPS. The Navy also has the capability to backfit CPS on ships already in Service. The Selected Area Collective Protective System (SACPS) has been installed on selected LHA-1 class ships. Air inside the zone is maintained at a higher pressure than the outside air to prevent leakage of contaminants into the protected zone. In the mid-term, the Navy is designing the V-22 Osprey to be the first Naval aircraft to incorporate CBR protection for both aircrew and passengers. The ability to provide a pressurized, contamination free environment is a design requirement. The Navy Shipboard Collective Protection Equipment (CPE) effort will increase the shipboard particulate filter life (from the current one or two years) to at least a three year service life, through the use of new particulate pre-filter materials and the use of a new HEPA filter media. The Shipboard CPE will thus provide millions of dollars of savings in life cycle costs by reducing shipboard maintenance requirements and providing energy efficient fans.

2.5 DECONTAMINATION

When contamination cannot be avoided, personnel and equipment must be decontaminated to reduce or eliminate hazards after NBC weapons employment. Decontamination systems provide a force regeneration capability for units that become contaminated. Modular decontamination systems are being developed to provide decontamination units with the capability to tailor their equipment to specific missions. Technology advances in sorbents,

coatings, catalysis, and physical removal will reduce logistics burden, manpower requirements, and lost operational capability associated with decontamination operations. The following sections detail CB decontamination science and technology efforts, modernization strategy, and Joint Service programs.

2.5.1 Decontamination Science and Technology Efforts

2.5.1.1 Goals and Timeframes. The goal of decontamination research and development is to develop technologies that will eliminate toxic materials without performance degradation to the contaminated object and be environmentally safe (see Table 2-7). This area includes decontamination of personnel, individual equipment, tactical combat vehicles, aircraft, facilities, and fixed sites. Decontamination technologies currently being pursued include enzymes, catalysts that improve reactivity, decontaminants that are effective in both fresh and brackish water, and improved reactive sorbents. Supercritical fluid technology and non-ozone depleting fluorocarbons are being investigated for sensitive equipment decontamination, while gaseous ozone is being evaluated as a reactive decontaminant for interior spaces of vehicles such as aircraft. Contamination control involves investigating procedures that minimize the extent of contamination pickup and transfer, and maximize the ability to eliminate the contamination pickup on-the-move as well as during decontamination operations.

Table 2-7. Decontamination Science and Technology Strategy

By 1998	By 2003	By 2008
• Demo improved sorbent delivery systems • Aircraft Interior Decon procedures (non-system)	• Sensitive Equipment Decon Systems • Demonstrate enzymatic decon • Fixed Site decon systems	• Demonstrate environmentally safe, sensitive equipment decon materials • New self-decontaminating materials • Improved decon material to replace DS 2 • Aircraft and other vehicle interior decontamination

2.5.1.2 Potential Payoffs and Transition Opportunities. The payoff from enhanced decontaminants and decontamination systems will be new non-corrosive, non-toxic, non-flammable, and environmentally safe decontamination systems suitable for a timely elimination of CB agents from all materials and surfaces. This ability will allow the forces to reconstitute personnel and equipment more quickly to increase combat efficiency and lessen the logistic burdens. In the future, reactive coatings may allow the continuation of combat operations without the need to disengage for decontamination. Dual use potential for environmental remediation, especially those dealing with pesticide contamination, is being exploited.

2.5.1.3 Major Technical Challenges. There are two principle technical difficulties associated with this effort. The first is the development of decontaminants which are reactive, non-aqueous, non-corrosive, safe to use on sensitive equipment, decontaminate a broad spectrum of chemical and biological agents, and environmentally safe. The second technical difficulty is the development of decontamination systems that effectively clean all surfaces and materials, while at the same time reduce the manpower and logistics burden. Also, new concepts or technologies for decontamination of fixed sites are needed.

2.5.1.4 Chem War 2000. To help guide future combat and material development efforts in the area of Fixed Site decontamination (and related activities) the Deputy Assistant to the Secretary of Defense for Counterproliferation and Chemical and Biological Defense, DATSD (CP/CBD), the Joint Staff (J-5) and the Joint Service Integration Group (JSIG) cosponsored a two-day simulation exercise during FY97 entitled Chem War 2000. The main objective of Chem War 2000 was to determine those equipment, doctrinal and operational solutions required for mitigating the effects of chemical warfare on the operations of rear area fixed sites, *e.g.*, aerial ports of debarkation (APODS), seaports of debarkation (SPODS), or logistic nodes. Chem War 2000 was attended by the Commanders-in-Chiefs' (CINCs) staffs, Service representatives (Combat and Material Developers), the medical community, and decontamination subject matter experts. Issues related to decontamination for two scenarios were addressed: a Major Theater of War (MTW) scenario, and a Small Scale Contingency (SSC) operation. During FY98 the results and recommendations from Chem War 2000 will be analyzed and staffed with the major participants. Road Maps to address the key issues (policy, doctrine, training, material, and resources) will then be developed and will form the basis for future exercises, demonstrations, studies, *etc.* required to firm up requirements and research and development programs.

2.5.2 Decontamination Modernization Strategy

Decontamination systems provide a force regeneration capability for units that become contaminated. Existing capabilities rely upon the physical application and rinse down of decontaminants on contaminated surfaces. Existing systems are effective against a wide variety of threat agents, yet are slow and labor intensive and present logistical, environmental, material, and safety burdens. To improve capabilities in this functional area, the Joint Services place emphasis upon new decontaminating technologies which reduce existing manpower and logistics requirements. They are safer on the environment, the warfighter, and equipment. Table 2-8 shows the roadmap for modernizing decontamination systems in DoD.

The goal of the NBC decontamination program area is to provide technology that removes and detoxifies contaminated material without damaging combat equipment, personnel, or the environment. Research and development of non-corrosive, all-agent multipurpose decontaminants and decontaminating systems for combat equipment, aircraft, personal gear, and skin remains a priority. Alternative technologies, such as sensitive equipment decontamination methods and large scale decontamination systems attract interest across the four Services. Table 2-9 provides an overview of Joint Service RDA efforts and Service involvement.

Table 2-8. Decontamination Modernization Strategy

	NEAR (FY98-01)	MID (FY02-06)	FAR (FY07-12)
Personal Equipment Decontam-inants	• **More reactive, high capacity adsorbent (M291/M295)**	• **Non-caustic, non-corrosive decontaminant for personnel and equipment** • Army-*Higher efficiency decon methods (Sorbent Decon)*	
Bulk Decontam-inants	• **Non-caustic, non-corrosive, easy to store and manufacture multipurpose decontaminants**	• **Decontaminants for fixed facilities** • Army -*Environmentally acceptable replacement for DS-2* • Army -*Enzymes for chemical agent decontamination* • Navy -*Less caustic capability*	• **Mission tailored decontaminants** • Navy -*Contamination resistant shipboard materials*
Expedient Delivery Systems		• **Auto-releasing coatings; reduces skin contact hazard & labor requirements**	• **Self-decontaminating auto releasing coatings; reduces man-power and logistic requirements eliminates skin contact hazard**
Deliberate Delivery Systems	• **High pressure water wash; mechanical scrubber; improved decontaminant dispenser (increased vehicle throughput)** • Army -*High pressure hot water washing and decontaminate scrubber capability; reduced water, labor, and logistic burden (M21/M22 Modular Decon System)*	• **Rapid large scale decon capability for fixed sites; reduced manpower and logistic burden** • **Non-aqueous capability for electronics, avionics and other sensitive equipment** • Air Force - *Sensitive equipment decontamination system for aircraft interiors*	• **Vehicle interior decon capability** • **Supercritical fluid decontamination apparatus** • Army -*Waterless decon capability for electronics and avionics*

1. Joint Service programs are highlighted in **BOLD** while Service unique are *italicized.*
2. Where applicable, systems which meet requirements are listed following the entry.

Table 2-9 Decontamination RDA Efforts

Category	Nomenclature	Status	USA	USAF	USMC	USN
Personnel	- M295 Individual Equipment Decontaminating Kit	Production	Fielded	Interest	Interest	Interest
	- M291 Skin Decontaminating Kit	Production			Fielded	
Combat Equipment, Vehicles, and Aircraft	- M17A2/A3 Lightweight Decontamination System	Production	Fielded	Interest	Fielded	Interest
	- M21/M22 Modular Decontamination System (MDS)	RDTE	Rqmt	Int-NIR	Int-NIR	Int-NIR
	- M17 Diesel Lightweight Decontamination System	RDTE		Int-NIR	Rqmt	Interest
	- Sensitive Equipment Decon	RDTE	Rqmt	Rqmt	Rqmt	Rqmt
Decontaminant Solutions and Coatings	- Sorbent Decontamination System - Solution Decontaminants	RDTE	Rqmt	Interest	Rqmt	Interest

Rqmt = Product Requirement
Interest = Product Interest
Int-NIR = Product Interest, No Imminent Requirement

* = sub-Product(s) of a Consolidated Joint Service Project
Rqmt, Interest = Sub-Product Requirement or Interest

2.5.3 Joint Service Decontamination Programs

The Army has developed the M291 skin decontamination kit as a replacement to the M258A1 decontamination kit for all Services, and is currently introducing the M295 for improved personal equipment decontamination. The M295 provides the warfighter a fast and non-caustic decontamination system for personal gear. A new adsorbent which is more reactive and has higher capacity is being developed to improve the performance of the M295 kit.

In the near- and mid- term, DoD continues to research new multi-purpose decontaminants as a replacement for bulk caustic Decontamination Solution 2 (DS2) and corrosive Super Tropical Bleach (STB). New technologies, such as sorbents, enzymatic foams, and reactive decontaminating systems are being explored and may offer operational, logistics, cost, safety, and environmental advantages over current decontaminants. It should be noted that present shipboard chlorine-based decontaminant solutions pose an unacceptable corrosion risk to Naval aircraft. Current procedures require the use of fresh water and normal aircraft detergent solutions.

In the far-term, the Services are seeking non-aqueous decontamination systems to provide for sensitive equipment decontamination at mobile and fixed sites. Additionally, there is interest and research in coatings which can reduce or eliminate the necessity of manual decontamination. A detailed description of the decontamination projects is provided in Annex C.

2.5.4 Other Decontamination Programs

In the near- and mid-term, the Army is developing the Modular Decontamination System (MDS) to enhance vehicle and crew weapon decontamination. The MDS will support deliberate decontamination for ground forces and possess mechanical scrubbing and improved decontaminant dispensing capabilities. It will also offer a reduction in size, weight, logistics burden, and workload requirements over existing decontamination systems. Similarly, the Marine Corps is exploring alternative man-portable decontamination systems and is assessing the feasibility of converting the gasoline powered M17 Lightweight Decontamination System (LDS) with a lightweight diesel engine.

2.6 EQUIPMENT FOR THE CHEMICAL/BIOLOGICAL RAPID RESPONSE TEAM

The Chemical-Biological Quick Response Force (CBQRF) concept has been re-defined as a focused Chemical/Biological Rapid Response Team (C/B-RRT) which is tasked with assisting emergency responders to chemical and biological crisis situations. The C/B-RRT is intended to coordinate with and integrate itself with the local emergency responder incident command structure in the event of a crisis. A major element of the C/B-RRT is the U.S. Army Technical Escort Unit's Chemical Biological Response Team (CBRT). Additional support would be provided by U.S. Army and U.S. Navy medical, analytical, and response assets. This coordinated team would use the equipment normally available to the first responders. In addition, it would use specialized equipment organic to DoD organizations not available to the first responders. This capability is supplemented by a pre-positioned package of specialized

NBC defense equipment that would be delivered within hours of notification to the contingency. (The equipment packages will be in an alert status, ready to deploy in four hours). The pre-positioned package consists of a suite of equipment for hazard containment, detection, personal protection, decontamination, and medical treatments and accessories. The packages include military items, such as those described in Annexes A-D, and non-military items. There will be five packages placed at five sites across the U.S., which include enhanced ("special event") packages at Pine Bluff Arsenal, AR, and in Alaska and Hawaii. The current concept for the quantities of equipment to be included in the pre-positioned packages is still evolving.

Given the potential involvement of other DoD and non-DoD responders, every effort is being made to ensure a commonality of equipment and capabilities among the responder groups. The development of methods that ensure coordination and communication among the emergency responder groups and the various elements of the C/B-RRT are also being given high developmental priority. Particular attention is being paid to coordination and integration of equipment requirements between the C/B-RRT and the U.S. Marine Corps' Chemical-Biological Incident Response Force (CBIRF). Additional information on CBIRF and emergency medical response is provided in Section 5.7.5 and 5.7.6 of this report.

2.7 NON-MEDICAL CB DEFENSE REQUIREMENTS ASSESSMENT

ISSUE: **Advanced technologies and new methods are currently being examined for fixed site decontamination. Follow-up investigations are planned over the next year to determine the requirements necessary to perform decontamination of large areas, including cleaning area to sustain cargo handling operations. Over the past year, the Services have worked together to improve the Joint orientation of NBC defense requirements. The work being accomplished will improve the equipment fielded in the near future. More emphasis needs to be placed on the Warfighting CINCs' requirements as input for equipment research and development. This is necessary to ensure that future equipment meets the needs of the Joint battlespace environment.**

SOLUTION: Areas of concern which are addressed under the management improvement initiatives include the following:

- Focusing and prioritizing chemical and biological detector programs to ensure that resources are leveraging the most promising technologies and are not diluted by excessive Service unique requirements.
- Developing advanced individual protection ensembles which minimally degrade an individual's performance for all tasks performed in contaminated environments.
- Identifying requirements for collective protection programs to ensure that enough assets are available to complete missions in a CB environment.
- Developing advanced detection capabilities for the purpose of directing decontamination efforts and monitoring the effectiveness of those efforts.

- Identifying an environmentally safe decontaminant and development of a capability to accomplish fixed site and sensitive equipment decontamination.

ISSUE: **The M-40 mask program was reviewed to assess the impact of reported problems in the manufacture and qualification of new masks on meeting the acquisition objectives for the mask and to identify corrective actions.**

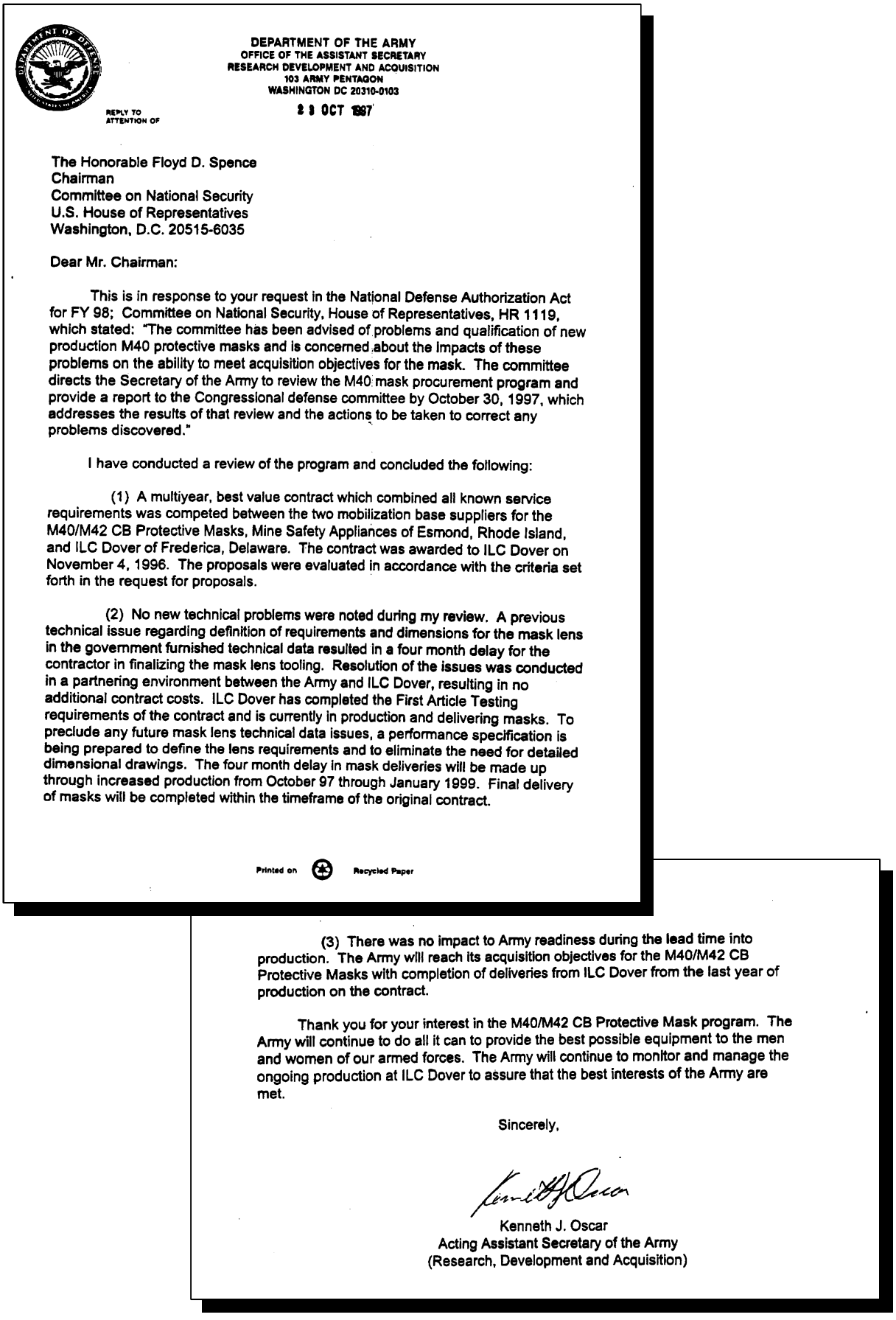
SOLUTION: A letter dated October 23, 1997—see Figure 2-1 below—addressing issues related to the M40 mask program was delivered to Congress as requested. Following is an extract from that letter addressing M40 mask issues:

- A multiyear, best value contract which combined all known service requirements was competed between the two mobilization base suppliers for the M40/M42 CB Protective Masks, Mine Safety Appliances of Esmond, Rhode Island, and ILC Dover of Frederica, Delaware. The contract was awarded to ILC Dover on November 4, 1996. The proposals were evaluated in accordance with the criteria set forth in the request for proposals.

- A technical issue regarding definition of requirements and dimensions for the mask lens in the government furnished technical data resulted in a four month delay for the contractor in finalizing the mask lens tooling. Resolution of the issues was conducted in a partnering environment between the Army and ILC Dover, resulting in no additional contract costs. ILC Dover has completed the First Article Testing requirements of the contract and is currently in production and delivering masks. To preclude any future mask lens technical data clarifications, a performance specification is being prepared to better define the lens requirements and to eliminate the need for detailed dimensional drawings. This performance specification will be completed by the end of Jan 98. The four month delay in mask deliveries will be made up through increased production from Oct 97-Jan 99. All deliveries of masks will be completed within the time frame of the original contract.

- There was no impact to Army readiness during the lead time into production. The Army will reach its acquisition objectives for the M40/M42 CB Protective Masks with completion of deliveries from ILC Dover from the last year of production on the contract.

Figure 2-1. Letter to Congress regarding M-40 Mask Issue



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH DEVELOPMENT AND ACQUISITION
103 ARMY PENTAGON
WASHINGTON DC 20310-0103

REPLY TO ATTENTION OF

28 OCT 1997

The Honorable Floyd D. Spence
Chairman
Committee on National Security
U.S. House of Representatives
Washington, D.C. 20515-6035

Dear Mr. Chairman:

This is in response to your request in the National Defense Authorization Act for FY 98; Committee on National Security, House of Representatives, HR 1119, which stated: "The committee has been advised of problems and qualification of new production M40 protective masks and is concerned about the impacts of these problems on the ability to meet acquisition objectives for the mask. The committee directs the Secretary of the Army to review the M40 mask procurement program and provide a report to the Congressional defense committee by October 30, 1997, which addresses the results of that review and the actions to be taken to correct any problems discovered."

I have conducted a review of the program and concluded the following:

(1) A multiyear, best value contract which combined all known service requirements was competed between the two mobilization base suppliers for the M40/M42 CB Protective Masks, Mine Safety Appliances of Esmond, Rhode Island, and ILC Dover of Frederica, Delaware. The contract was awarded to ILC Dover on November 4, 1996. The proposals were evaluated in accordance with the criteria set forth in the request for proposals.

(2) No new technical problems were noted during my review. A previous technical issue regarding definition of requirements and dimensions for the mask lens in the government furnished technical data resulted in a four month delay for the contractor in finalizing the mask lens tooling. Resolution of the issues was conducted in a partnering environment between the Army and ILC Dover, resulting in no additional contract costs. ILC Dover has completed the First Article Testing requirements of the contract and is currently in production and delivering masks. To preclude any future mask lens technical data issues, a performance specification is being prepared to define the lens requirements and to eliminate the need for detailed dimensional drawings. The four month delay in mask deliveries will be made up through increased production from October 97 through January 1999. Final delivery of masks will be completed within the timeframe of the original contract.

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(3) There was no impact to Army readiness during the lead time into production. The Army will reach its acquisition objectives for the M40/M42 CB Protective Masks with completion of deliveries from ILC Dover from the last year of production on the contract.

Thank you for your interest in the M40/M42 CB Protective Mask program. The Army will continue to do all it can to provide the best possible equipment to the men and women of our armed forces. The Army will continue to monitor and manage the ongoing production at ILC Dover to assure that the best interests of the Army are met.

Sincerely,

Kenneth J. Oscar
Acting Assistant Secretary of the Army
(Research, Development and Acquisition)